RTCA Special Committee 186, Working Group 3

ADS-B 1090 MOPS, Revision A

Meeting #3

Data Analysis of Appendix I, Table I-1 Combining Odd and Even Outputs using Combinations of Conservative and Brute Force Error Correction Techniques

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SUMMARY
Response to Action Item 2-13, Analyze reply reception probability for alternative matrices if the conservative error correction technique is the only error correction method applied. It was determined that the data presented at the 2nd meeting included utilization of the sliding window error correction technique. The data contained herein shows the original data as well as the matrix comparisons using only the conservative technique, and the conservative and brute force techniques.

Background

Data was presented at the second ADS-B 1090 MOPS Rev. A meeting that showed an extended squitter decoding performance increase by combining the odd and even sample patterns using an alternative matrix to the one suggested in Appendix I of the MOPS. The reception technique utilized a 5-5 multiple amplitude enhanced bit and confidence declaration approach and included conservative, brute force, and sliding window error correction. Due to a higher than acceptable risk of undetected errors, it has been determined that the sliding window error correction is not an acceptable method for extended squitter reception. For purposes of appropriately measuring extended squitter reception performance, the 1090 MHz Frequency Measurement Facility (RMF) software was modified to separate messages into the following categories: all high confidence, some low confidence but no errors, conservative correction, brute force correction, sliding window correction. For messages that contain errors, the conservative technique is tried first, if that fails, then brute force is tried, if brute force fails then sliding window is tried.

The data contained in this presentation is in response to the action item that requested that the performance with each prom table be presented with using only the conservative error correction technique. The performance is shown 3 ways: with only conservative, with conservative and brute force, and the original data presented that utilizes all three methods.

The data was processed off-line using a software implementation of an enhanced reception technique developed to analyze the data collected using the 1090 RMF. The data samples processed for this presentation are two 2-minute samples recorded aboard N40 on May 24, 2000 over Frankfurt, one starting at 10:56:25 GMT and the other starting at 12:25:00 GMT.

The Combination Tables

Below are the three tables tested. The first table is the original table that is defined in Table I-1 in Appendix I.

Original Odd and Even Combination Table

Odd (1,3,5,7,9) **Even (2,4,6,8,10)**

	H1	**M1**	**L1**	**H0**	**M0**	**L0**
H1	H1	H1	H1	L0	H1	H1
M1	H1	H1	L1	H0	L0	L1
L1	H1	L1	L1	H0	L0	L0
H0	L0	H0	H0	H0	H0	H0
M0	H1	L0	L0	H0	H0	L0
L0	H1	L1	L0	H0	L0	L0

Alternative Odd and Even Combination Table 1

Odd (1,3,5,7,9) **Even (2,4,6,8,10)**

	H1	**M1**	**L1**	**H0**	**M0**	**L0**
H1	H1	H1	H1	L0	**L1**	H1
M1	H1	H1	L1	**L0**	L0	L1
L1	H1	L1	L1	H0	L0	L0
H0	L0	**L0**	H0	H0	H0	H0
M0	**L1**	L0	L0	H0	H0	L0
L0	H1	L1	L0	H0	L0	L0

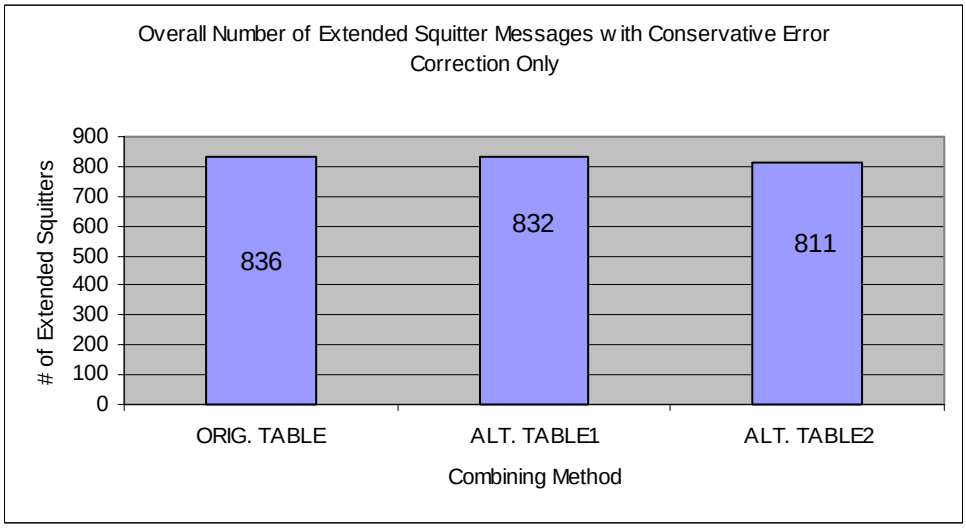
Alternative Odd and Even Combination Table 2

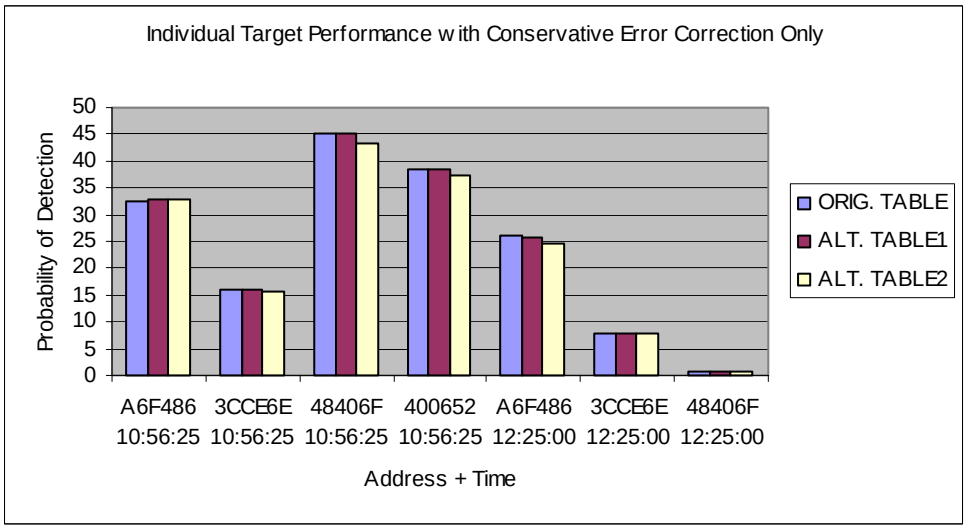
Odd (1,3,5,7,9) **Even (2,4,6,8,10)**

	H1	**M1**	**L1**	**H0**	**M0**	**L0**
H1	H1	H1	H1	L0	**L1**	**L1**
M1	H1	H1	L1	**L0**	L0	L1
L1	H1	L1	L1	**L0**	L0	L0
H0	L0	**L0**	**L0**	H0	H0	H0
M0	**L1**	L0	L0	H0	H0	L0
L0	**L1**	L1	L0	H0	L0	L0

Conservative Error Correction Only

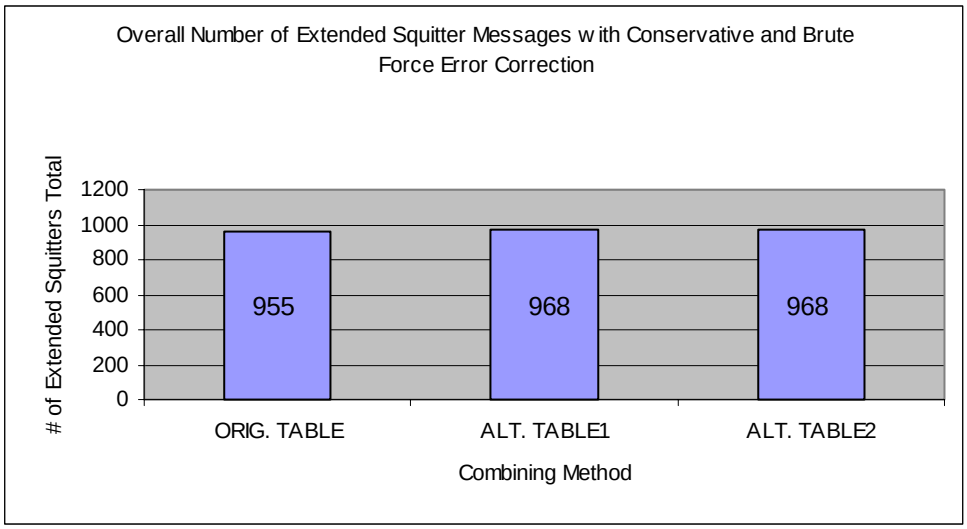
The following data shows the extended squitter reception performance with each table type with applying only the conservative error correction technique. Except for marginal gain with one target, the performance typically either stayed the same or decreased with the alternative tables.

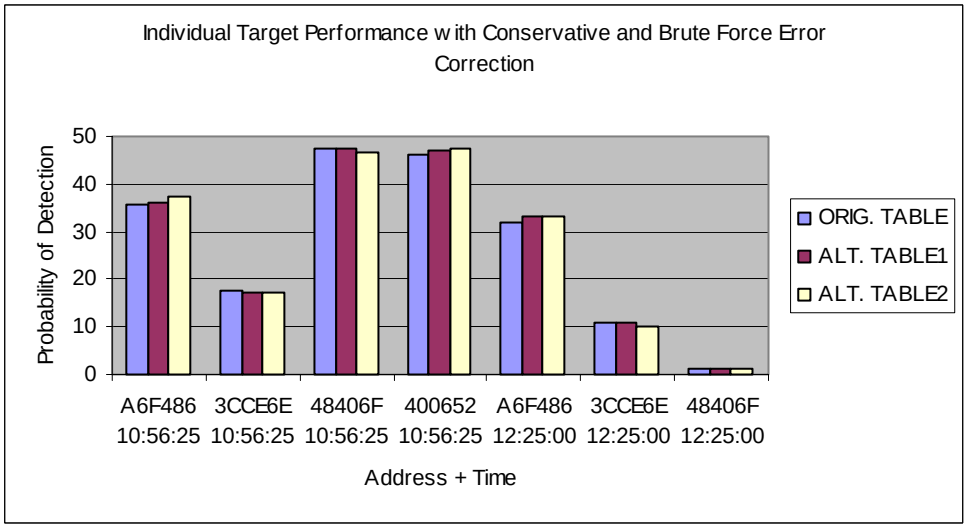




Conservative and Brute Force Error Correction

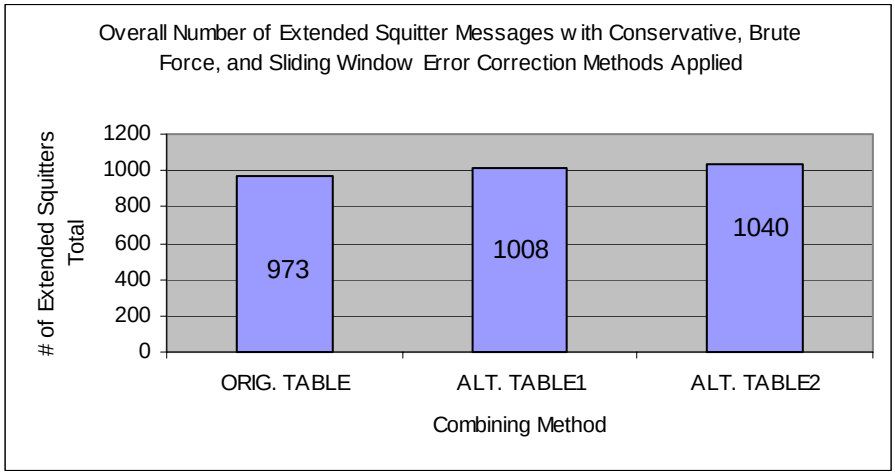
The following data shows the extended squitter reception performance with each table type with applying the conservative error correction technique first, and then the brute force technique. Overall, there was a slight increase in performance with the alternative tables but the performance with individual targets varies. There was an increase in performance with some targets but a decrease in performance with others.

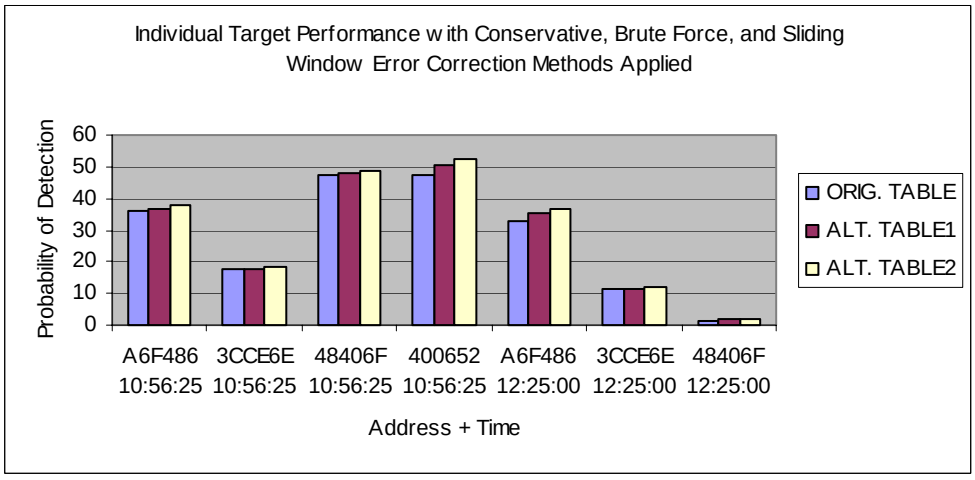




Conservative, Brute Force, and Sliding Window Error Correction

The following data shows the extended squitter reception performance with each table type with applying conservative error correction technique first, then the brute force, and then the sliding window technique. This is the data presented previously, and it shows that most of the gain in performance is attributed to the sliding window error correction technique.





Conclusion

The data shows that most of the alternative table performance increase with the RMF implementation is achieved only when using the sliding window error correction technique. There is some performance increase when using only conservative and brute force, but the performance in this case still varies from target to target. This data does not support changing the matrix suggested in Appendix I. However, since implementation of the odd/even technique may vary in many ways, developers should not be precluded from testing alternative matrices.